FORM XXVI

PARTICULARS OF DIRECTORS, MANAGERS AND MANAGING AGENTS AND OF ANY CHANGES THEREIN

(Myanmar Companies Act, See Section 87)

Name of Company : Puma Energy Asia Sun Co., Ltd

Presented by : U Win Kyaw Kyaw Aung
Director

	The Present Christian name or names of surnames	Nationality, National Registration Card No.	Usual Residential Address	Other Business Occupation	Changes
1.	Mr. Robert Michael Jones	British P.P No. 500731043	25 Oriole Cres, Singapore 288618.	Businessman	Director
	Ms. Toni Sharon Weber	British P.P No. 761309009	#40-28 Citylights, 90 Jellicoe Road, Singapore 208749.	Businesswoman	Director
3.	U Win Kyaw Kyaw Aung	Myanmar 13/Ma Sa Ta (Naing) 031876	Building No. A, Room No. 1002, New University Avenue Road, Shwe Than Lwin Condo, Sayar San Quarter, Bahan Township, Yangon Region, The Republic of the Union of Myanmar.	Businessman	Director

NOTE : (1) A Complete list of the Directors or Managers or Managing Agents shown as existing in the last particulars.

(2) A note of the changes since the last list should be made in the column for " Changes" by placing against the new Director's name the word " in place of .... and by writing against any former Director's name the word "dead " " resigned" or as the case may be giving the date of change against the entry.

Signature ....

Designation U Win Kyaw Kyaw Aung
Director..................

Dated this ....

ပြည်ထောင်စုသမ္မတမြန်မာနိုင်ငံတော်
စွမ်းအင်ဝန်ကြီးဌာန
မြန်မာ့ရေနံဓာတုဗေဒလုပ်ငန်း
နေပြည်တော်

အကြောင်းအရာ။ <u>သဘောထားမှတ်ချက်ပြန်ကြားခြင်း</u>

ရည်ညွှန်းချက်။ စွမ်းအင်ဝန်ကြီးဌာန၏ ၆-၂-၂၀၀၃ရက်စွဲပါ စာအမှတ်၊ ၀၁၂ / ၂၄၈ / ထ(၁၂၂ / ၂၀၁၃)

၁။ အထက်အကြောင်းအရာပါကိစ္စနှင့်ပတ်သက်၍ ပုံးမားစွမ်းအင်ကုမ္ပဏီမှ သီလဝါဒေသရှိ မြေကွက်အမှတ်(၃)တွင်ကတ္တရာနှင့်ဆက်စပ်ပစ္စည်းများ တင်ပို့ရာတွင်အသုံးပြုမည့် ဆိုင်ခံတံတားနှင့် သိုလှောင်ကန်တည်ဆောက်ရေးလုပ်ငန်းအပေါ် မြန်မာ့ရေနံဓာတုဗေဒလုပ်ငန်း၏သဘောထားမှတ်ချက်ကို ဆောလျင်စွာပြန်ကြားပေးနိုင်ပါရန် ရည်ညွှန်းချက်ပါစာဖြင့် အကြောင်းကြားလာပါသည်။

၂။ ပုံးမားစွမ်းအင်ကုမ္ပဏီမှ သီလဝါဒေသရှိမြေကွက်အမှတ်(၃)တွင် ကတ္တရာအပါအဝင် ရေနံထွက်ပစ္စည်းများအားတင်ပို့ရာတွင် အသုံးပြုမည့်ဆိပ်ခံတံတားနှင့် သိုလှောင်ကန်တည်ဆောက်ရေးလုပ်ငန်းများကို လုပ်ထုံးလုပ်နည်းများနှင့်အညီတင်ပြခွင့်ပြုချက်ရယူ၍ ရင်းနှီးမြှုပ်နှံသူများအား ပွင့်လင်းမြင်သာသည့် တင်ဒါစနစ်ဖြင့်ခေါ်ယူမည့်ကိစ္စနှင့်ပတ်သက်၍ မြန်မာ့ရေနံဓာတုဗေဒလုပ်ငန်းအနေဖြင့် ကန့်ကွက်ရန်မရှိပါကြောင်း သဘောထားမှတ်ချက်ပြန်ကြားတင်ပြအပ်ပါသည်။

၆/၂/၁၃

(စိန်ဝင်း)
ဦးဆောင်ညွှန်ကြားရေးမှူး

<u>စွမ်းအင်ဝန်ကြီးဌာန</u>

စာအမှတ်၊ ၁၅၀၄(၁)/ဦးဆောင်/၂၀၁၂-၂၀၁၃(၀၁၁)
ရက်စွဲ ၊၂၀၁၃ခုနှစ်၊ ဖေဖော်ဝါရီလ ၆ ရက်

PUMA ENERGY

PUMA ENERGY IRRWADDY PTE LTD

Managing Director
Myanma Port Authority
Ministry of Transport
Yangon

Date: 25th Feb 2014

Subject: Informing the status of acquiring letters of opinions from respective ministries

Your Excellency,

Puma Energy plans to lease Plot No. (3) at Thilawa, Thanlyin-Kyauktan Township owned by Myanma Port Authority and to build a bitumen and petroleum related products terminal on this plot under Foreign Investment Law. In order to submit this investment proposal to Myanmar Investment Commission, Puma Energy is trying to get opinions, feedbacks and remarks from

1. Ministry of Mines
2. Ministry of Energy
3. Yangon Regional Government
4. Fire Services Department

Respectfully yours,

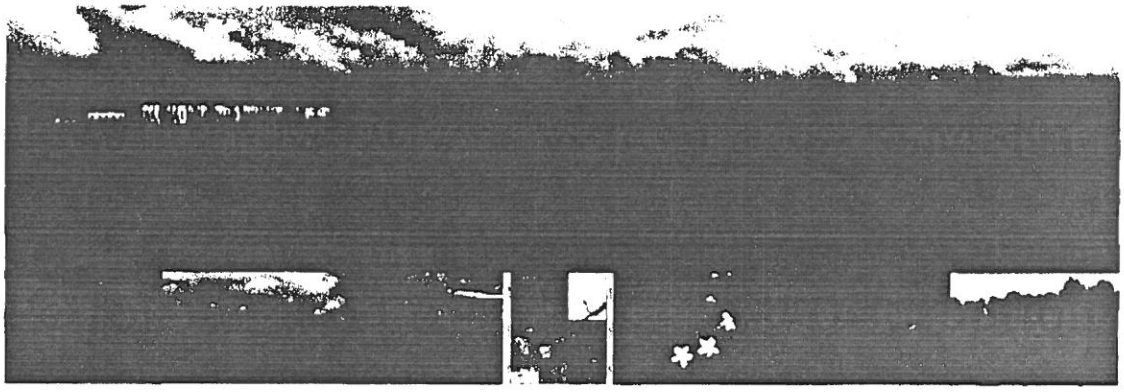
Mr. Robert Michael Jones

Promoter of the Proposal

ENVIRONMENTAL IMPACT ASSESSMENT

for

Petroleum Products Storage and Distribution Terminal in Myanmar



ENCA

(Environment & Nature Conservation Associates)

August 2013

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ABBREVIATIONS

ACGIH	American Conference of Governmental Industrial Hygienist
ADB	Asian Development Bank
BANCA	Biodiversity And Nature Conservation Association
CGI	Corrugated Galvanized Iron
DBA	Decibel A-weighting
DCS	Data Cable System
DHSHD	Department of Human Settlement and Housing Development
EDS	Electronic Data System
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EMS	Environmental Management System
GAD	General Administrative Department
GPS	Global Positioning System
HIV	Human Immunodeficiency Virus
AIDS	Acquired Immunodeficiency Syndrome
HP	Horse Power
HSEMS	Health, Safety and Environmental Management System
ICM	Integrated Costal Management
ICCPR	International Covenant on Civil and Political Rights
ISO	International Organization for Standardization
KV	Kilovolt
MCC	Main Control Cabinet
MIPL	Myanmar Integrated Port Ltd.
MITT	Myanmar International Thilawa Terminal
MOECAF	Ministry of Environmental Conservation and Forestry
MVA	Mega Volt Ampere
NGO	None Government Organization
ODA	Overseas Development Assistance
PES	Payment for Ecosystem Services
PHC	Pre-stressed High-strength Concrete
SEZ	Special Economic Zone
STD	Sexually Transmitted Diseases
TEL	Tetra-ethyl Lead

EXECUTIVE SUMMARY

With the aim for supporting the Myanmar's energy sector to meet the increasing local fuel demand resulting from the recent economic growth Puma Energy Thilawa Terminal Co., Ltd has proposed to develop a Petroleum Products Storage and Distribution Terminal in Thilawa Port Zone of Yangon Region. Thilawa Port Zone falls in Kyauktan Township in the south of Yangon City. The Puma Energy Thilawa Terminal Co., Ltd has leased Plot number 3 at the Thilawa Port.

The proposed activity requires authorization from competent environmental authorities before it can be undertaken. The Ministry of Environmental Conservation and Forestry (MOECAF) and Myanmar Investment Commission (MIC) are the competent authorities and their decision will be based on the outcome of Environmental Impact Assessment (EIA) process. Myanmar Environmental Conservation Law which includes 14 Articles has been enforced recently. The Articles state concrete commitments to protect the environment and move a significant step towards the effective action against environmental protection measures. The Department of Environmental Conservation under the Ministry of Environmental Conservation and Forestry (MOECAF) is the legal institution of this new environmental law and efforts have been made to undergo detailed process at present while protecting the environment and conserving natural resources.

As part of the development, Environmental Impact Assessment (EIA) for the proposed bulk storage facilities was entrusted by Puma Energy Thilawa Terminal Co., Ltd to the ENCA (Environmental and Nature Conservation Associates). ENCA therefore conducted environmental and socio-economic baseline surveys and reconnaissance site visits covering the area within 2.5 km radius of the project location.

The proposed project site is located on the east bank of Yangon River, about 25 km from the sea entrance, and at the GPS location of N 16 40 22.75" and E 96 14' 57.75", as shown in the project Location map (Figure 1). The site is situated at a straight line distance of about 4.5 km away from Zamani Inn dam-- the main fresh water source, and about 4 km from Aye Mya Thida Ward --the closest residential area. There is no village and residential area within the 2.5 km radius of the defined project impact zone.

The nature of project is storage, distribution and marketing of refined oil, gas and bitumen from industry sector. The design of the storage facilities can be classified as vertical cylindrical above ground bulk storage tanks where a total petroleum product volume of 88,000 cubic meters can be stored. It is also planned to install additional storage facilities which can be capable of storing a total petroleum product of 73,000 cubic meters in future tanks (See following table). An oil jetty with a berth (3-7 meters draft on low tide, 9-10 meters at high tide) is designed for one partially laden MRs (50,000 DWT,185 meters LOA), or fully laden MRs, or 2x 5,000 DWT vessels. Loading of small river barges is foreseen for bitumen, jet fuel, gasoil, gasoline and LPG

No industrial development can be expected without any adverse impact on environment. The activities of proposed project are expected to make a number of negative and positive impacts. All environmental risks must be reduced and managed through implementing preventive measures and sound management systems.

The following measures are recommended for the project: Fire prevention should be adequate, as specified by the SANS 10089 standards. Health and safety regulations should be adhered to in accordance with the Regulations pertaining to Health and Safety. The Environmental Management Plan should be used as an on-site reference document during all phases (Planning, Construction and Operation) of the proposed bulk fuel storage facility, and auditing should take place in order to determine compliance with the EMP. Parties responsible for transgression of the EMP should be held responsible for any rehabilitation that may need to be undertaken. With future expansion of the proposed bulk fuel storage facility, compliance with environmental, health and safety issues must again be checked and improved where necessary during an EIA. It is advised that baseline data be gathered before any construction activities takes place. Special attention should be given to air quality, soil quality and groundwater quality. Regular monitoring of the parameters analysed during the baseline study should be conducted to evaluate the impact of the facility on the environment. Any polluted soil or groundwater encountered during the baseline survey and during the construction process must be reported to the relevant authorities and the contaminated soil and or ground water must then be disposed of in an applicable manner.

All the positive impacts are socio-economic and may be experienced at local and regional levels. The most important of this is energy security to drive economic development in the region and in Myanmar as a whole. This will meet certain of the country's commitments in terms of 2030 and the Millennium Development Goals (MDGs), such as facilitating development in Myanmar and improving socio-economic status of its people. The proposed project would contribute to the economy of Thanlyin/Kyauktan area and this Region by creating jobs and diversifying the economic activity. While there are more limited job creation opportunities for locales related to the operational phase, these are none-the-less significant bearing in mind the high unemployment rate in the area. To some extent this project will also create job opportunities during the construction phase, albeit for limited period. In addition, those employed in the construction phase can develop skills, potentially increasing the ability for individuals to seek employment in the future.

In general, the proposed bulk fuel storage facility would pose limited environmental and social risks. The proposed bulk fuel storage facility would contribute to the economy of our country Myanmar and the Yangon Region by creating jobs and diversifying the economic activity.

The site is generally suitable for the proposed bulk fuel storage facility. All environmental risks can be minimised and managed through implementing preventative measures and sound management systems. It is recommended that environmental performance be monitored regularly to ensure compliance and that corrective measures be taken if necessary. It is also recommended that this information be made available to the public at a regular basis.

1.1 Project Scope and Objectives

The scope of this EIA is to determine the potential environmental impacts emanating from the construction and operation of the proposed bulk storage facility and associated infrastructures. Relevant environmental data collection and reconnaissance site visits have been carried out. Potential bio-physical and social impacts will also be identified and addressed in this report. This phase section of terms of reference stipulates that:

- An ecological baseline for the selected site
- An environmental impact identification and assessment be made and to provide a description of the likely environmental impacts of the proposed project during the construction and the operational phase respectively
- Mitigating measures be identified and documented to keep adverse environmental impacts to a minimum
- An environmental management plan (EMP) be drafted, including an outline for monitoring and management programs during construction and operational phase respectively, including possible plans for monitoring and penalties in case of non-compliance
- Gaps and fatal flaws and uncertainties encountered be documented
- The EMP must be drafted as such that it can be used as a separate document.

1.2 Propose and Need of Environmental Impact Assessment (EIA)

Environmental Impact Assessment (EIA) is an important procedure for ensuring that the likely effects of new development on the environment are fully understood and taken into account before the development is allowed to go ahead. The procedure is a means of drawing together, in a systematic way, an assessment of a project's likely significant environmental effects. This helps to ensure that the importance of the predicted effects, and the scope for reducing them, are properly understood by the public and the relevant competent authority before it makes its decision.

Environmental impact assessment enables environmental factors to be given due weight along with economic or social factors, when planning applications are being considered. It helps to promote a sustainable pattern of physical development and land and property use in cities, towns and countryside. If properly carried out, it benefits all those included in the planning process.

From the developer's point of view, the preparation of an environmental statement in parallel with project design provides a useful framework within which environmental considerations and design development can interact. Environmental analysis may indicate ways in which the project can be modified to avoid possible adverse effects.

In this regard, the EIA is to identify potential environmental impacts and to provide associated mitigation measures for the identified impacts, associated with the selected site. The aims and objectives of the EIA are:

- to establish and describe the known ecological baseline conditions for environmental, health and social conditions existing in the proposed project area;
- to conduct an environmental impact identification and assessment, and to provide a description of the likely environmental impacts of the proposed project during the construction and operational phases;

environment and its natural resources. It is the responsibility of the state and every citizen to preserve its natural resources in the interest of present and future generations. Environmental protection should always be the primary objective in seeking development."

Recently, Myanmar Environmental Protection and Conservation Law which includes 14 Articles have been enforced in April, 2012. The Articles state concrete commitments to protect the environment and move a significant step towards the effective action against environmental protection measures. The Department of Environmental Conservation under the Ministry of Environmental Conservation and Forestry (MOECAF) which is legal institution of this new environmental law and efforts have been made to undergo detailed process at present while protecting the environment and conserving natural resources.

2.2 Myanmar Laws Relating to Environment

There are also many environment related laws, acts, legislations and regulations. All of them deal with the general protection of the environment in one way to another. Please see below:

A. Administrative Sector

1. The Yangon Police Act, 1899
2. The Towns Act, 1907
3. The Village Act, 1907
4. The Explosive Substances Act, 1908
5. The Poisons Act, 1919
6. The Police Act, 1945
7. The Emergency Provision Act, 1950
8. The Territorial Sea and Maritime Zones Law, 1977

B. Agriculture and Irrigation Sector

9. The Embankment Act, 1909
10. The Pesticide Law, 1990
11. The Fertilizer Law, 2002
12. The Plant Pest Quarantine Law, 1993 and amended in 2011
13. The Seed Law, 2011

C. Culture Sector

14. The Protection and Preservation of Cultural Heritage Region Law, 1998

D. City Development Sector

15. The Yangon Water-works Act, 1885
16. The City of Yangon Municipal Act, 1990 and amended in 1995 and 1996)
17. The Underground Water Act, 1930

43. The Myanmar Pearl Law, 1995

L. Science and Technology Sector

44. The Science and Technology Development Law, 1994
45. The Atomic Energy Law, 1998

M. Transportation Sector

46. The Canal Act, 1905
47. The Yangon Port Act, 1905
48. The Defile Traffic Act, 1907
49. The Ports Act, 1908
50. The Inland Steam Vessels Act, 1917
51. The Myanmar Aircraft Act, 1934
52. The Motor Vehicles Law, 1964 and amended in 1989
53. The Highways Law, 2000
54. Conservation of Water Resources and River Law, 2006

Within the existing legal framework, the following rules and regulations were promulgated to protect and conserve biodiversity in Myanmar.

1879 - Elephant Preservation Act

1883 - Amendment to Elephant Preservation Act

1902 - Forest Act

1912 - The Wild Birds and Animals Protection Act

1936 - The Protection of Wildlife Act

1956 - Amendment to the Protection of Wildlife Act

1992 - Forest Law

1994 - The Protection of Wildlife and Protected Areas Law

1995 - Forest Rules

1995 - Forest Policy

2002 - The Protection of Wildlife and Protected Areas Rules

(Source - NBSAP 2011)

These previous environment related laws will constitute major roles and also strengthen the new law to be effectively acted.

2.3 International Guidelines and Approach

Today, the sustainable development has become one of the most important focuses in the worldwide scope. According to definition of United Nations, sustainability requires the reconciliation of environmental, social and economic demands. The United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro in June 1992– the Earth Summit– focused world attention on the close links that exist between the environment and socio-economic development. One of outputs of this summit was

System (HSE-MS) has been agreed and published in 1994 as a guideline document. The E & P Forum is recognized as the representative body facilitating the sharing of knowledge and information on best practice within the industry. While there are some important differences in handling health, safety and environmental issues, management is tending to coverage towards system models such as those represented by ISO 9000 and 14000 series.

However, it covers only exploration and production activities and, is not specifically reflected in large scale storage and transportation issues or downstream processing.

2.4 International and Regional Conventions, Protocols and Agreements

There are so many environmental laws and treaties in existence today; no other area of law has generated such a large body of conventions on a specific topic.

International environmental agreements are not only known as generally multilateral treaties but also as convention, agreement, protocol, etc. Specific environmental issues are directly dealt in the majority of such conventions. Protocols are subsidiary agreements built from a primary treaty. The Kyoto Protocol -1997 is the most widely known protocol in international environmental laws, which followed from the United Nations Frameworks Convention on Climate Change (UNFCCC). Protocols are especially useful in the environmental field where they may be used to regularly incorporate recent scientific knowledge, despite existing in many areas of international law.

Among others, international conferences related topic on environment is said to be: United Nation Conference on Human Environment-1972; World Commission on Environment and Development 1988; United Nations Conference on Environment and Development-1992; and the World Summit on Sustainable Development.

Myanmar's "National Environmental Policy" of 1994 elevated the profile of environmental considerations in the country's policy. This was followed by the preparation of the country's Agenda 21 in 1997. Internationally Myanmar's contacts have increased and by now, the country has signed some 30 international environmental treaties and conventions, including the following:

Table 1 Environmental Conventions/ Protocols/ Agreements Signed or Ratified by Myanmar

No	Environmental Conventions/ Protocols/ Agreements	Date of Signature	Date of Ratification	Date of Member	Cabinet Approval Date	Remark
Regional						
1	Plant Protection Agreement for the Southeast Asia and the Pacific Region, Rome, 1956		4-11-1959 (Adherence)	4-11-59		
2	Agreement on the Networks of Aquaculture Centers in Asia and the Pacific, Bangkok, 1988		22-5-1990 (Accession)			
3	ASEAN Agreement on the Conservation of Nature and Natural Resources, Kuala Lumpur, 1985	16-10-1997				
4	ASEAN Agreement on Trans boundary Haze Pollution	10-6-2002	13-3-2003 (Ratification)		7/2003 (27-2-2003)	
International						

No	Environmental Conventions/ Protocols/ Agreements	Date of Signature	Date of Ratification	Date of Member	Cabinet Approval Date	Remark
	1994					
11	Vienna Convention for the Protection of the Ozone Layer, Vienna, 1985		24-11-1993 (Ratification)	22-2-1994	46/93	
12	Montreal Protocol on Substances that Deplete the Ozone Layer, Montreal, 1987		24-11-1993 (Ratification)	22-2-1994	46/93	
13	London Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer, London, 1990		24-11-1993 (Ratification)	22-2-1994	46/93	
14	The Convention for the Protection of the World Culture and Natural Heritage, Paris, 1972		29-4-1994 (Acceptance)		6/94 (9-2-94)	
15	ICAO ANNEX 16 Annex to the Convention on International Civil Aviation Environmental Protection Vol. I Aircraft Noise		(Accession)			
16	ICAO ANNEX 16 Annex to the Convention on International Civil Aviation Environmental Protection Vol. II Aircraft Engine Emission		(Accession)			
17	United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/ or Desertification, Particularly in Africa, Paris, 1994 (UNCCD)		2-1-1997 (Accession)	2-4-1997	40/96 4-12-96	
18	Convention on International Trade in Endangered Species of Wild Fauna and Flora, Washington, D.C., 1973; and this convention as amended in Bonn, Germany, 1979		13-6-1997 (Accession)	11-9-1997	17/97 (30-4-1997)	
19	Agreement Relation to the Implementation of Part XI of the United Nations Convention on the Law of Sea of 10 December 1982, New York, 1994		21-5-1996 (Accession)			
20	Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas, Rome, 1973		8-9-1994 (Acceptance)			
21	Cartagena Protocol on Biosafety, Cartagena, 2000	11-5-2001			13/2001 (22-3-2001)	
22	Kyoto Protocol to the Convention on Climate Change, Kyoto, 1997		13-8-2003 (Accession		26/2003 (16-7-2003)	

3.3 Rationale and Justification

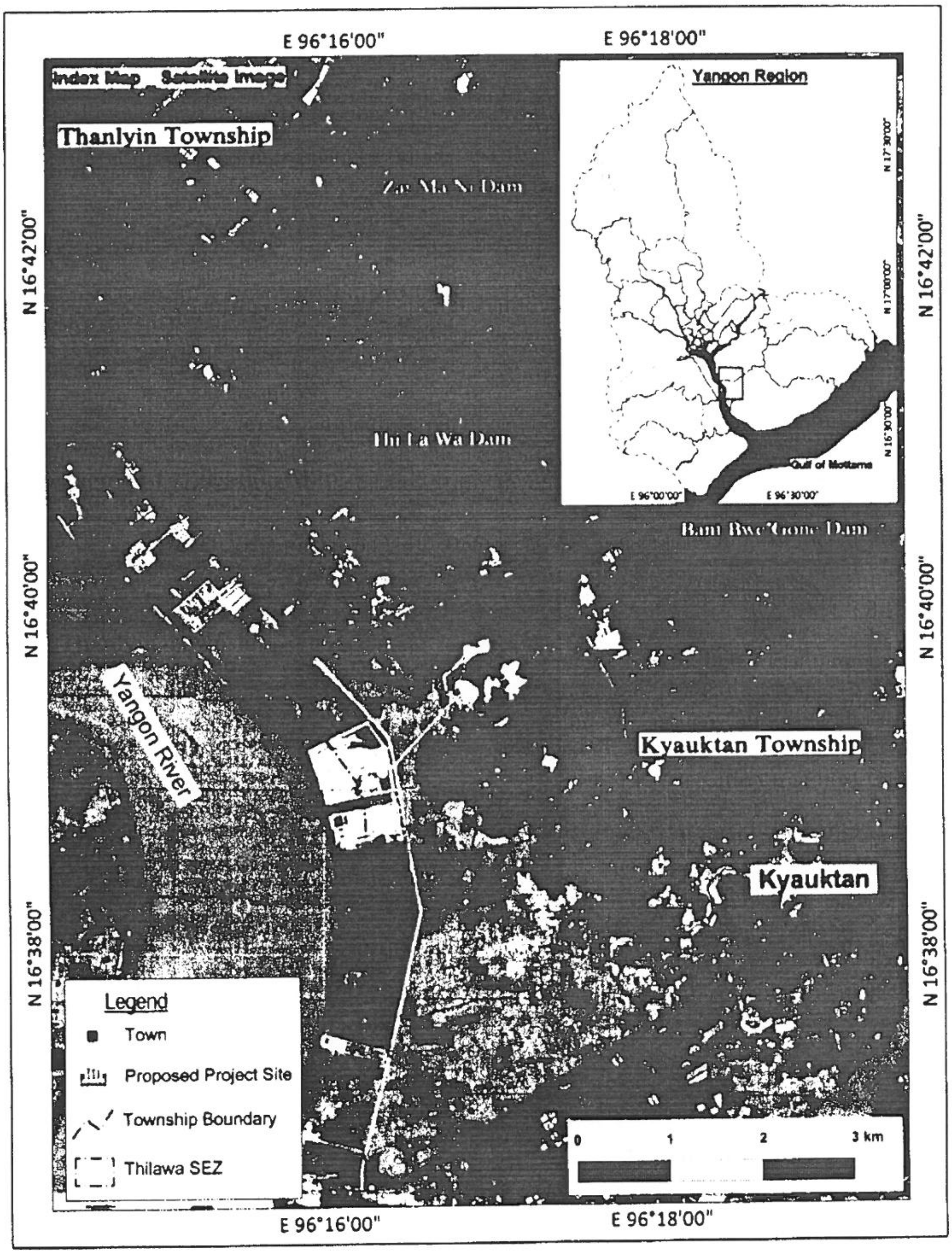
The civilian government of the Republic of the Union of Myanmar has been carrying out political reforms simultaneously with economic reforms since it took office in early 2011. Myanmar has seen a lot of changes in every sector. These changes are very encouraging, and the President of the Republic of the Union of Myanmar who has taken reform measures showed his superb courage to the world that he is very eager to change Myanmar into a democratic and prosperous nation. Aims and objectives have been set and are being realized for establishment of an industrialized nation. Industrial regions and zones are being established in correct regions and more factories and workshops are being opened. New factories and workshops are in operation to produce import-substitute products. Heavy Automobile Factories, Farming Equipment Factories, Machine and Machine Tools Factories in some regions are gaining production momentum. Myanmar's economic development is becoming stable and mature. As a result demand for refined oil market and growth rate of GDP development will gradually increase.

However, the country had seen slow foreign investment in the last two years as it is focusing on enacting the foreign investment law and removing economic sanctions imposed on it. Agriculture businesses alone could not make the country rich. The country has welcomed establishment of industrialized country and needed capital and technologies. The country has enacted foreign investment law for foreign investors. And Myanmar could ensure easing of economic sanctions and EU's reinstatement of GSP rights. The rest of the work would be decided only at the Congress as the US administration lifted its economic sanction against. It is the best time for foreign investors to make investment in Myanmar Mutually-beneficial Foreign Investment Law covers prescriptions that protect investors. For country's economic development, there is a bag of challenges and difficulties as well as other opportunities. Myanmar is like a bridge that connects South Asia, South East Asia and East Asia. And Myanmar shared borders with China, India, Bangladesh and ASEAN countries which is a big market with a population of 2000 million. Resource-rich Myanmar with a population of 60 million has favourable climate, fertile soils and adequate workface.

Regarding energy fuel demand, world demand for energy fuels gradually increased due to the rapid growth of global demand as well as the emergence of the global energy crisis during the past two decades. In Myanmar, the supply of refined oil ran on a government planned rationing system in 1980s. Myanmar had shifted from centralized economy to market oriented one on over past two decades. In 2004, Myanmar's diesel andgasoline prices were 180 kyats per gallon and 160 kyats per gallon respectively. At that time the government of Myanmar had a fixed guidance price of gasoline and diesel at kyats 1500 per gallon in October, 2005. In 2007, the government gasoline price was raised to kyats 2500 per gallon and diesel price to 3000 kyats per gallon to adjust refined oil pricing mechanism with the rising global international crude oil price. The gas stations formerly owned by the Ministry of Energy have been transferred to the private sector which has wholesalers and retailers. The fuel prices have so far reached kyats 4100 per gallon of gasoline and kyats 3900 per gallon of diesel in relation to the global trend. In 2010, Myanmar national demand for refined oil is about 2.98 million tons including about 0.71 million tons from domestic production supply and about 2.27 million tons from imports. Since late 2010, Myanmar fuel market became more open and the price of fuel more market-oriented, changing linked with the Singapore MOPS price.

Moreover,simultaneously restriction to buy new cars was lifted. Citizens who could earn a considerable amount of foreign currency were allowed to import newer cars. Old cars

Figure -1: Location Map



There are 37 rectangular blocks constitutes this Thilawa Port Zone managed by Yangon Port Authority. The approximate measurement of each block is 200-meter breadth along the bank of Yangon River and the length of 750 meters. Puma Energy has leased plot No. 3 at Thilawa Port. This plot will be developed into a liquid bulk terminal, and adjacent on both of its sides, other terminals are being developed. The first 209 meters longitudinally measured from the main road of Thilawa Port will be left for tank truck parking area, future covered and open warehouse and truck filling station and the remainder 541 ,meters close to the Yangon River will be occupied by the proposed

3.5.2 Codes and Standards

- BS EN 1990, Eurocode: Basis of Structural Design, BSI
- BS EN 1991, Eurocode 1: Actions on Structures, BSI
- BS EN 1992, Eurocode 2: Design of Concrete Structures, BSI
- BS EN 1993, Eurocode 3: Design of Steel Structures, BSI
- BS EN 1994, Eurocode 4: Design of Composite Steel and Concrete Structures, BSI
- BS EN 1997, Eurocode 7: Geotechnical Design, BSI
- BS EN 1998, Eurocode 8: Design of Structures of Earthquake Resistance, BSI
- BS 6349, Code of Practice for the Design of Maritime Structures, BSI
- BS EN 1317, Road Restraint Systems
- BS EN ISO 14122, Safety of machinery-Permanent means of access of machinery, BSI 2001
- BS EN ISO 12944, Paint and Varnishes – Corrosion protection of steel structures by protective paint systems, BSI 1998
- BS EN 13174, Cathodic protection for harbor installations, BSI 2001
- DNV-RP-B401, Cathodic protection design, DNV 2005
- BS EN 12696, Cathodic protection of steel in concrete, BSI 2000
- BS EN 12812, Falsework, Performance requirements and general design, BSI, 2004
- API RP 2A-WSD, recommended practice of planning, designing and constructing fixed offshore platforms – working stress design, 21st edition, API 2007
- BS EN 206 Concrete, BSI
- BS 4449, Steel for the reinforcement of concrete – Weldable reinforcing steel – Bar coil and decoiled product – Specification, BSI 2005
- BS EN 10025, Hot rolled products of structural steels, BSI 2004
- API SPEC 2W, Specification for Steel Plates for Offshore Structures, TMCP 2006
- Guidelines for the Design of Fender Systems: 2002, PIANC
- Criteria for Movements of Moored Ships in Harbours: 1995, PIANC
- Mooring Equipment Guidelines, 3rd Edition: 2008, OCIMF
- Recommendations for Oil Tanker Manifolds and Associated Equipment, 4th Edition: 1991, OCIMF
- EAU 2004, Recommendations of the Committee for Waterfront Structures Harbours and Waterways, 8th Edition
- API 620: Recommended rules for the design and construction of large, welded, low-pressure storage tanks
- ASME IX: Welding standards
- API Standard 650: Welded steel tanks for oil storage
- ASME VIII Div. I: Boiler and pressure vessel code

- Annex V: Prevention of Pollution by Garbage of Ships
- Annex VI: Prevention of Air Pollution from Ships

3.6 Description of Construction and Installation

The main component of this terminal is the fuel storage facility. The storage facility is designed to install 3 groups of current tanks (vertical cylindrical, above ground typed, steel structured) with the total storage capacity of 88,000 cubic meters anda total of 73000 $m^3$of petroleum products will be also stored in the futuretanks.(T***able -2***)

the deck at full deflection of the restraint system. Equipment and structures adjacent to the roadway shall be located outside the working width of the restraint system.

Safety ladders will be provided in accordance with international safety requirements. They shall be located at convenient bents. Gaps in the edge protection at the top of the safety ladders shall be closed by detachable chains.

The proposed project is designed to install the holding down system to the positions and levels as required for the pipelines, which are:

- 3 × 10″ pipelines for white products (to see going vessel and both barge berths);
- 1 × 10″ pipeline for bitumen (to see going vessel and one barge berth);
- 1 × 10″ future pipeline for LPG (to see going vessel and both barge berths);
- 1 × 10″ future (spare) pipeline;
- 1 × 10″ pipeline for firefighting water system;
- 1 × 4″ future vapour return pipeline for LPG;
- 1 × 2″ line for potable water:
- 1 × 2″ instrument air pipeline.

Also minimally one electrical duct (or tray), and one instrumentation duct (or tray) of 800 mm wide and 300 mm high are to be provided.

The piled quay consists of continuous concrete deck or composite steel and concrete deck structure supported by steel or concrete piles. The pile length has been based on a typical piled quay with vertical and raking Concrete SPUN piles in a regular 5 m by 5 m grid. The estimated pile lengths are: vertical piles: D 800 mm, 35-40 m (working load: 100-150 tons) and raking piles: D 800 mm, 45-50 m (working load: 300-350 tons). Seagoing vessels and river barges are expected to moor at the quay. At any time the quay shall be capable of receiving either a single sea going vessel or 2 river barges simultaneously. The following range of design vessels shall be capable of transporting all products.

- The Seagoing Vessels Berth shall be designed as a minimum to accommodate design vessels ranging from 7,000 DWT to 50,000 DWT. The full range of design vessels shall be capable of transporting all products.
- The River Barges berths shall be designed as a minimum to accommodate design barges ranging from 1,000 DWT up to 5,000 DWT. The full range of design vessels shall be capable of transporting all products.

The loading area of sea going vessels will be located at the middle section of the piled quay. The loading area for sea going vessels shall allow for the following marine loading arms and hose connections:

- 1 × 10″ Loading Arm for White products;
- 1 × 10″ Loading Arm for Jet Fuel:
- 1 × 10″ Loading Arm for Gasoline;
- 1 × 10″ Hose Connection for Bitumen;
- 1 × 10″ Future Loading Arm for LPG.

- Bollards with a clear working area of 1.5 m to the rear and sides;
- Area lighting;
- Walkway seating
- Safety provisions including edge protection, handrails, lifebuoys, etc;
- Falls of 1:50 to the deck surface to prevent ponding and drain water directly into the sea;
- Ladders protected by fenders to the rear of the mooring dolphin structures to allow small boats to tie up alongside.

The walkway shall take the form of lightweight steel trusses or standard steel beams. The deck shall be open mesh flooring. Galvanized tubular steel handrails shall be provided on both sides of the walkway.

The walkways will have a minimum clear width of 1200 mm, measured from any equipment mounted inside the edge protection.Pipes and electrical cable trays running along the walkways shall be inside the edge protection and above the floor level to enable safe installation and maintenance.The maximum gradient of a walkway shall be 10%. Where this would be exceeded, stairs are to be provided at the end of the walkway. The stair shall have the same clear width as the walkway and minimum going of 250 mm. the stairs may be on the walkway structure of the adjacent structure provided they are not obstructing any operational requirements.Area lighting is required for all walkways. This may be provided by light fittings on adjacent structures. Where walkways from part of the emergency escape route to a place of safety, emergency lighting is required.

Fendering is fundamental to the safe operation of the berths. The Contractor shall ensure that fender systems are procured and installed which enable safe use of the berths and meet all the functional requirements for quay operations.

The fendering system shall allow for safe berthing of all vessels expected to use the berths.Berthing energy shall be calculated in accordance with the PIANC guidelines.

The rated berthing energies of the fender units shall be reduced by a factor recommended by the supplier but not less than 10%.A positional tolerance as per the recommendations of EAU2004 will be taken into consideration when assessing the berthing operations. Sufficient fenders must be provided to comply with the recommendations of BS6349 and OCIMF Guidelines and prevent vessel impact with the structure.Berthing angles between 0° and 6°shall be considered for vessels above 20,000 DWT and berthing Angles between 0° and 10° for vessels below 20,000 DWT.Berthing velocities shall be based on the appropriate curve from the PIANC Guidelines but shall not be taken as less than 0.1 m/s.The distance from the end of the vessel to the contact point shall be determined from the fender positions relating to the berthing target but shall not be less than 25% of the vessel length between perpendiculars. The factor of safety shall be those stated in the PIANC Guidelines.The fenders will be capable of resisting the design wind force on the vessel distributed over the fenders against the flat side of the vessel with a factor of safety of 1.5 m buckling fenders can resist this load with a factor of safety of 1.5 m their buckling load.

In accordance with the appropriate codes and standards the mooring arrangement and line forces will be determined.The mooring configuration shall consider vessel manifolds to be central to the appropriate marine loading arm of hose connection location. An appropriate allowance for the offset between the centre of the vessel and the centre of its manifold group shall be justified.The mooring arrangement shall be in

Patrol and access roads will be included in the design. An access road from the main road to the terminal shall be also constructed. Approximate length will be 750 m band the width shall be 10 m. This road shall be within the project premises (200 m × 700 m).

3.7 Construction Methods and Materials Used

All vertical cylindrical storage tanks are of steel structure design. It is obvious that welding, metal cutting, threading, rolling and grinding works in the processes of mechanical fabrication will be carried out with the use of steel sheet, welding rods and welding gas during the construction period. Normal construction materials such as cement, bricks, river shingle, sand, deformed iron bar, angle iron bar, hard wood, window glass, roofing sheet, and floor/walling tile will be used for building the various structures like road and drainage, foundation of fuel storage tanks, office buildings and jetty foundation. According to the geotechnical report and data, many 35-50 metres long piles shall be adopted for the piling foundation. The riprap linings and the dike setting retaining wall will be selected as the revetment structure.

3.8 Operation Functions and General Scheme

The fuel unloading pumps are normally incorporated in incoming fuel vessels however the loading pumps are stationed on the farm base. The storage tanks will receive incoming oil products through unloading arms installed at the jetty and the pipelines connected between jetty and storage tanks. Oil product outgoing will be transported by land using trucks on load and by barge on the river. The jetty is designed for both loading/unloading of vessels with 1 x 50,000 DWT OR 2X 5,000 DWT. Ship pumps discharge pressure is 10 bar.

The pipelines from/to jetty will be included 10″ dedicated bidirectional pipeline for bitumen (pipe diameter to be finalized during detailed engineering), 2 × 10 bidirectional and interchange lines for gasoil/gasoline (pipe diameter to be finalized during detailed engineering), 1 × 10″ dedicated bidirectional pipeline for jet fuel and 8″dedicated line for LPG (future).

There will have one dedicated loading arm at the jetty for gasoil, gasoline and jet fuel, and one for LPG (future). Hose connection will be provided on either side of each loading arm to be used for loading gasoil, gasoline and jet fuel onto small barges. A main line using hose will be used to receive (import) bitumen. The main line would have a tee connection on the two sides to discharge (export) bitumen to 2 small barges.

Process control includes automatic tank gauging on the tanks, tank level switches for High and High/High alarms and weigh bridges on the 2 bitumen truck loading positions. Automatic metering systems will be installed at the truck loading positions for white products and LPG (future). Emergency Shutdown (ESD) system will be installed at the truck loading bays to stop the pumps in case of emergency and close the flow control valves at the loading bays.

The storage Terminal will provide bitumen (2 grades), gasoline (2grades), gasoil (2 grades), jet fuel and LPG.

The storage terminal will have to be functioning products import via ships off loading, products export via truck loading, product recirculation on tanks and tank to tank transfers, products export through vessels and LPG export through bottling facility (future).

Products are to be loaded onto trucks by loading positions as follows:

shall be used for 1 grade of bitumen and the other pump for another grade. One new positive displacement export pump for loading barges/small vessels at 200m^3/hr will be installed. One positive displacement export pump will provide for loading barges/small vessels of 200m^3/hr. Also, pumps shall be used for tank recirculation operations and tank to tank transfers

Two Gasoil Truck Loading Pumps with a capacity of 90m^3/hr will be installed for loading gasoil. These pumps shall be interconnected. It is foreseen that 1 pump shall be used for 1 grade of Gasoil and the other pump for another grade. One Gasoil export pump for loading barges/small vessels at 350m^3/hr will be installed. One export pump will provide for loading barges/small vessels at 350m^3/hr. Also, pump shall be used for tank recirculation operations and tank to tank transfers

Two Gasoline Truck Loading Pumps with a capacity of 90m^3/hr will be installed for loading gasoline. These pumps shall be interconnected. In future, 1 pump will be used for 1 grade of gasoil and the other pump for another grade. A gasoline export pump for loading barges/small vessels at 350m^3/hr will be installed. One export pump will provide for loading barges/small vessels at 35m^3/hr. Also, pumps shall be used for tank recirculation operation and tank to tank transfers. Gasoil and Gasoline export pumps shall be interchangeable. It shall be also feasible to run in parallel.

For the truck station, the plan is : (1) Have 8 fueling positions (four pump islands), (2) Underground steel tanks 4x22500 litres (3) Four units of section type dispensing pumps with two products hoses (one hose gasoline and 1 hose gasoil), and (4) Convenient store.

One Jet Fuel Truck Loading Pump with a capacity of 90m^3/hr and a loading arm shall be installed and one truck loading pump and a loading arm will provide for jet fuel. Two LPG truck loading pumps will be installed for loading LPG in future (bottling facility pumps).

The truck loading terminal is designed to use for loading products as follows:

- truck loading positions for bitumen-dedicated
- Gasoil/ Gasoline truck loading configuration
  - Islands with 1 loading arm for gasoil 1 and gasoline 1
  - Loading arms can be positioned left or right of the island
  - Provision for future loading arms for gasoline 2 and gasoil
- 1 truck loading position for jet fuel—dedicated
- 2 future LPG truck loading position-- dedicated

3.9 Decommissioning

A life span for project operation and the structural design life of all buildings and foundations are 20 years and 50 years respectively according to the project design. The given corrosion allowance of the steel structured oil storage tanks is the most influential factor for the project life span. It is expected that the validity of (and/or) decommission or rehabilitation of there will be determined or decided by Myanmar inspection authority and international inspection agencies including insurance companies.

4 ENVIRONMENTAL AND SOCIOECONOMIC BASELINE CONDITIONS

The aim for this chapter is to give an overview of the existing environmental conditions against the potential impact over the proposed project influenced area in 2.5 km radius. Strictly speaking, this chapter provides results and findings of the environmental assessment team, which focuses on project related environmental and socioeconomic baseline conditions, socioeconomic status, access to public goods and services, physical environmental status and biodiversity nature in particular.

4.1 Socioeconomic Status

There is no village and residential area within the 2.5 km radius of the defined project impact zone. The closest community called New Phalan Village/ Aye Mya Thida Ward that is located at N 16° 39' 22.4" and E 96° 17' 20.8" is on east bank of Yangon is about 4 km away from the project site.

In this area,there are problems of the low salinity river floods during the rainy season. This area can therefore be classified as a post monsoon semi-agricultural land. The old Phalan village was located in Thilawa Industrial Zone once, and it was relocated to the present location in 1988 by the Department of Human Settlement and Housing Development of the Ministry of Construction for the development of industrial zone. Each household received kyats 20,000 as a compensation for resettlement. The old village was renamed as "Aye Mya Thida Ward" under the administration of Kyauktan Township.

By law, the Thilawa Industrial Zone is the legal owner of this proposed project area now. In some ways, the industrial zone does not seem to have progressed much in the recent years. This creates an opportunity for precious owners of paddy fields to grow on their farmlands or other suitable places to earn their livelihood.

ENCA assessment team conducted a socioeconomic survey in the village administered by Kyauktan Township of Yangon Region.

According to previous surveys, population in New Phalan Village/Aye Mya Thida ward was 620 as of January, 2012. Of which 293 were male and 32 female. There were 63 under 5 year children consisting of 31 males and 32 females and 46 numbers of the elderly over 60 years old among the total population in the village. A hundred per cent of population was Buddhists made up of Bama. The village had 150 households. Out of 150, 137 households had been dwelling for more than 10 years, 4 for 7 to 10 years, 3 for 4 to 6 years, 1 for 1 to 3 years and the remaining 5 for less than 1 year. At present, many economic migrants are found in this village.

People in this village are earning their living by following types of occupation: garment factory employee, wage labour of MITT Company, other company employee, farmer, planting betel-leaf, odd job, livestock breeder, fisherman, government employee, vendor, trader, carpenter, motorbike carrier, shopkeeper, taxi driver, traditional physician, and others (such as broker). The income of households varied widely.Fifty percent of total household earned average income of 0.11 to 0.4 million kyats in three months. The majority of households resided at respective 40 feet by 60 feet plots. Most of the houses in this village are built of wood and CGI roofing. About 30 percent of total houses are built with bamboo mat walling and thatched leave roofing and a few are concrete buildings and brick noggin buildings with CGI roofing.

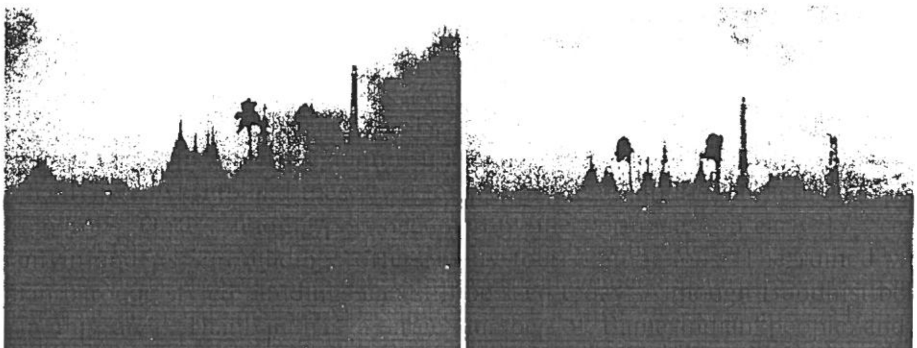
It can be generally assumed that the building quality of individual houses is a proxy indicator of their wealth living status.It is found out that about 60 percent of the

Distributed generation of electricity has a big role to play as a catalyst for social change. Despite the high voltage lines crossing over their houses, all resettled households in Aye Mya Thida Ward did not have access to common electricity supply line normally provided by the Electric Power Corporation in the past. Since May, 2013, the Electric Power Corporation has distributed power to the village.

The main responsible body of the public management affairs is the General Administrative Department (GAD) under the Ministry of Home Affair. The Administrator of Aye Mya Thida Ward who is in a subordinate position to the Township Officer of the General Administrative Department is the key person of the official line of contact. Although the role of civil society is still weak, the religiously-based social welfare groups are active in communal events, religious ceremonies, marriage and funeral. The people pay homage to two monasteries located in Aye Mya Thida Ward and the old Phalan Village area. The latter of course was exempt from resettlement. It can be said that the social life of the ward centres on these monasteries.

Religion and Heritage

In actuality, no national inheritance exists in the 2.5 km radius of the considered area. However, the area falls under the administration of Kyauktan Township that is the closet to the Thanlyin Township and these two townships are the tourist attraction in Yangon and its environs. Once a trading port occupied by the Portuguese in early 17^{th} century, the Thanlyin and its surroundings offers many tourist attractions. The ruined wall of Lusitanian baroque styled buildings can still be seen today. Although Buddhist belief is strong in this area, Thanlyin has a large number of Bama-Indian people and their customs and way of life are determined by the Hindu religion. The old buildings still stand in evidence of the days of Portuguese occupation. The 270-metre long bridge spanning the Bago River made possible the 45 minutes' drive from Yangon. Kyaik-kyauk Pagoda and Kyauktan Pagoda in the creek are worth visiting.



Yelae Kyauktan pagoda

Nature of tide is semi-diurnal, and there are two inflows and two outflows a day. At Yangon station, differences of average tide level, grand tide level and minor tide level are 4.08 m, 5.2 m and 1.8 m respectively. The following tide levels from the plain of Sule Pagoda point used as zero are: the record highest level in history: 7.11m; the lowest level in history: -0.24m; average high level through years: 5.76 m; average low level through years: 0,49 m; and average level: 3.12m.

4.2.2 General Geology and Hydrogeology

Geologically, the proposed area is characterized by recent alluvium overlying the Irrawaddian Formation and Peguan Group, and it is almost a flat area just 2 to 10 m above mean sea level and level enough to extensive rice cultivation. It is more properly a meandering plain, with old meandering features of Yangon River running in a general north-south direction and several short streams with meandering of oxbow lakes and lakes as vestiges as depicted in satellite (see following map) the recent alluvial unit is mainly composed of clayey silt with some sand and lateritic soil. The tank farm site itself is situated on the meandering plain of Yangon River. At the eastern part of the area, where the Para Gyi ridge rises to elevation, the Irrawaddian Formation of Miocene-Pliocene age and Peguan Group are well exposed as lower units.

In this area, lakes and most swamps, usually flooded in rainy season, favour breeding ground of fish and hence fish industry, including those products from ponds in reclaimed swamps and wetlands, is an important local business after rice plantation. Nearby industrially development projects and the projects of special economic zone are now in progress and land use in this surrounding area will change significantly in the near future.

As a drive for examining groundwater quality, lithology and groundwater level in the project site, a 2-inch diameter tube well was sunk to 150 feet deep. Groundwater of the 0 - 150 feet horizon in the project site is highly saline. In fact, water quality of shallow aquifers existing along the east bank of Yangon River is not suitable for domestic, irrigation and industrial purposes. Groundwater levels of the tube wells in this areavary from 3.5 m to 6.5 m depending on seasonal fluctuation and tide levels. The lithology and water quality results of the well installed in the proposed site are presented in***Annex-2***.

However, the studies of groundwater chemistry indicate that the shallow groundwater is of low to moderate salinity in the eastern part of the area including the Special Economic Zones. Although there is little variation in the degree of salinity in the vertical direction (that is, with depth) there is some variation in the horizontal direction (that is, laterally).

During the previous surveys water samples from Yangon River (Station 1 and Station 2), Zarmini reservoir were tested alreadyin ISO-TECH Laboratory in Yangon for testing following parameters: pH, Temperature, Biological Oxygen Demand, Chemical Oxygen Demand, Total Dissolved Solid, Nitrate, Nitrite, Mercury, Chromium, Arsenic, Oil and Grease, Phenol, Sulphate, Chloride, Electrolytic Conductivity, Lead, Turbidity, Alkalinity, Iron, Dissolved Oxygen, Ammonia, Nitrogen, Unionized Ammonia, Free chlorine, Bromine, Iodine, Carbon dioxide, Copper, Silica and Bacterial Growth (***Annex*** *2*).The water quality results ofabove mentioned water sources and the tube well in the proposed project site are tabulated in ***Table-3***.

Based on water quality test results the river (sea) water characteristics are influential in quality of groundwater in the proposed project site and immediate vicinity and hence it is not suitable for domestic consumption, irrigation use and industrial purpose. No hazards such as rock falls, mudflows and slumps otherwise known as landslides and erosion as a result of a variety of geologic processes have been reported and there is still

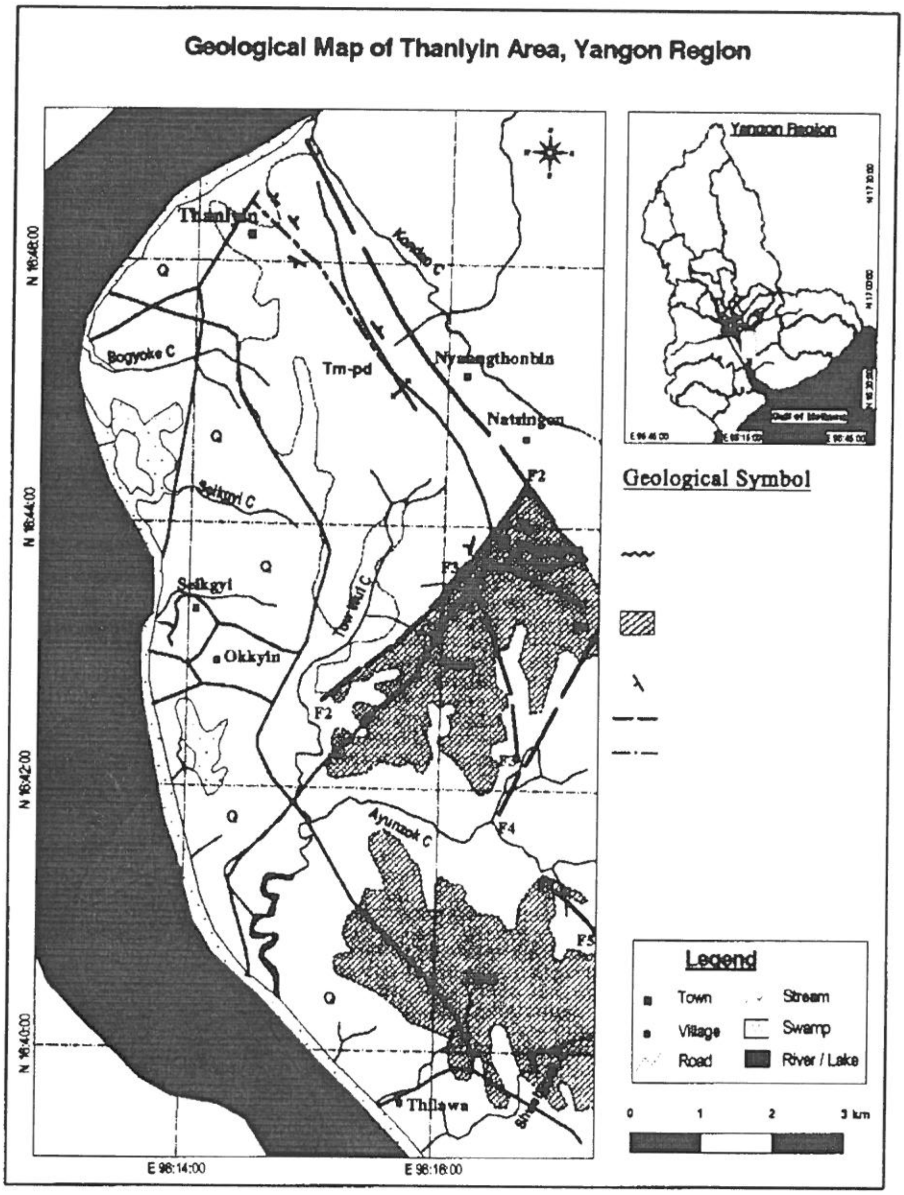


Figure 1 General Geology

4.3 Ambient Air

For ambient air quality testing, the administrative area at the elevation of 11 metres and the storage area at the elevation of 19 metres were selected as two sample sites. Measurements of Total Suspended Particulate Matters (TSPM), Respiratory Particulate Matter (PM_{10}), Sulphur dioxide (SO_2) and Nitrogen dioxide (NO_2) in 24-hour mean and Nitrogen dioxide for 1 hour and Ammonia and Carbon dioxide in the ambient air were taken. Based on 24-hour measurement level of TSPM and PM_{10} each sampling period was identified by using high volume sampler with a glass-fibred filter and SO_2 and NO_2. The results are mentioned in ***Table-4***.

4.5 General Characteristics of Yangon River

The Yangon River which starts from the confluence of Bago and Hlaing Rivers in the south of Yangon City flows generally southward to its mouth in the Gulf of Martabin. The Bago River originates from the southern portion of Bago Yoma and the Haling River rises in a western extension of Bago Yoma near Okkan Town. In the Yangon River, as in the Bago, there has been excessive silting due to erosion and sedimentation. That is estimated to be 37 tons of silt per year.

The Yangon River is the most important maritime access to Myanmar. The narrowest point is located in Hmawwun Lump buoy with a 650 metre width, where a 39 course alteration is required to pass through in this rift define, and the Middle Bank at the upstream is the second highest. The average tidal range and the mean tidal range at the Elephant Point (the sea entrance to Yangon River) are 5.76 m (18.9 ft) and 4.27 m (14 ft) respectively during the spring tide period, and the average tidal velocity is 2 to 3 m/s. The maximum surface wind speed 40 – 50 mph (34.7 – 43.5 nautical miles/hr) is observed during the monsoon. Non-machine fishing boats and fishing gears can be seen along the Yangon River approach. The allowable depth to enter for draught vessels is the Outer Bar of 5.18 m below the chart datum and the Inner Bar of 3.96 m. Between the Inner Bar and Outer Bar is 17.38 nautical miles distant. Vessels departing from Yangon Port have got to cross the Outer Bar in time otherwise they would have anchored at the port and waited for the required high tide.

The new Thilawa Port has some significant strength that lies in deduction of navigation time, Fairway anchorage waiting time and traffic congestion. It can also accommodate larger size containers and cruise ships. The ship sailing with tide from the Fairway to the Thilawa Port takes 2 to 2⅓ hours and the sailing time for outgoing vessel from Thilawa Port to the fairway is 2⅙ to 2⅔ hours (against tide) compared to the Yangon Port which is being used by vessels with a maximum capacity of 15,000-tons, 167-metre length and 9-metre draft. The Thilawa can accommodate 20,000-ton, 200-metre length and 9-metre draft.

There are 16 jetties at the Yangon Port and 6 jetties at Myanmar International Terminal Thilawa (MITT) along the Yangon River already. A total of 22 vessels can therefore be moored simultaneously. According to ongoing port development plan, Yangon River capacity is expected to increase jetty facilities as well as accessibility of bigger ships with deeper draft in the near future.

4.6 Biodiversity in the area

Priority areas for biodiversity conservation in Myanmar includes Key Biodiversity Areas KBAs, Important Bird Areas IBAs*, Primary corridors, Endemic Bird Areas EBA*and secondary areas and lastly Protected Areas System # PAS of Myanmar. Any development or industries in or adjacent to these areas should be avoided to prevent any destruction to the habitats and globally threatened species and biodiversity.

This project area lies at the southern edge of the Irrawaddy (Ayeyarwaddy) Plain Endemic Bird Ares EBA 132 and the expected endemic bird expected to find here is White-throated Babbler *Turdoidesgularis*. Earlier in January 2012 ornithological survey in this same area recorded this species. This species is considered **least concern** by **IUCN** and is not given priority for conservation.(See results ofornithology survey in ***Annex-4***)

- Seven species of amphibians and 8 species of reptiles were observed.The list of the recorded reptiles and amphibians, material and methods and name of scientists are shown in ***Annex-5***.

Small Mammals (e.g., rodents)

Small mammals are the most diverse group and account for more than half of the total mammal fauna in any given area. They affect the structure, composition, and dynamics of ecosystems through natural processes such as pollination, seed dispersal and depredation, mycorrhizal dispersal, insectivory, and as food for predators (DeMattia et al. 2004; Mangan and Adler 2002; Muchhala and Jarrín-V 2002; Napolitano et al. 2008; Naranjo et al. 2003; Steiner 1981; Vieira and de Moraes 2006; Walker et al. 2007; Williams-Guillén et al. 2008). Myanmar occupies one of the richest mammalian for any country.A total of only one mammal species was encountered during the survey; one species belonging to family *Muridae*). The material and methods, names of scientists and the list of recorded small mammals are shown in ***Annex-6***.

Understanding the world's biodiversity is a central goal of ecological, evolutionary, and conservation sciences. Biodiversity is a basic support system for life, which represents a system of many interdependent processes (Nunes, 2003). Myanmar occupies one of the richest mammalian for any country. Small mammals such as bats are good indicators of habitat disturbance (Castro-Luna et al. 2007; Medellín et al. 2000; Solari et al. 2002; Wilson et al. 1996). Of them, small mammals have been particularly useful in the study of elevational gradients, mainly because they form well-defined assemblages (in contrast to medium-sized and large mammals) along such gradients (Lomolino 2001; Mena and Vázquez-Domínguez 2005; Patterson et al. 1998). Small mammals (e.g., bats and rodents) are the most diverse group and account for more than half of the total mammal fauna in any given area. They affect the structure, composition, and dynamics of ecosystems through natural processes such as pollination, seed dispersal and depredation, mycorrhizal dispersal, insectivores, and as food for predators (DeMattia et al. 2004; Mangan and Adler 2002; Muchhala and Jarrín-V 2002; Napolitano et al. 2008; Naranjo et al. 2003; Steiner 1981; Vieira and de Moraes 2006; Walker et al. 2007; Williams-Guillén et al. 2008). In the present study was carried out to know the occurrence and diversity of small mammals' presents in the Oil storage project, Thilawar environs.

Similarly flora, aquatic, mammal and herpetological surveys also reveal no significant threats to important habitats and loss of globally threatened species.

Moreover the project area lies far from any IBA, KBA, PAS and primary corridors.

The details of the flora, fauna and aquatic surveys are shown in ***Annex-3***to *7*.

4.7 Results of Investigation of Aquatic organism

Fossil oil is toxic to aquatic life if ingested or absorbed through the skin. It also fouls the fur and feathers of wildlife and smothers aquatic habitats and beaches. Leakage of oils, oil wastes and mixtures may directly cause damage to fishery resources, aquatic biota and coastal habitat. Biodegradation of oil also generates polymerized oil particles and toxic aromatic fractions using dissolved oxygen in the water, which indirectly cause damages to bottom biota and habitat. Both effects may seriously damage coastal ecology. Fishery resources, including shellfish, may be spoiled by oil and toxic substances generated by biodegradation. Some oils contain carcinogens and their contamination has been reported in fishery resources.

- In meroplankton composition of July survey, most are invertebrate larvae which are food organisms for higher level of food pyramid. Higher level food pyramid organisms of fish and shrimp larvae were also found in the samples but the quantity was not much. This means that July is not breeding season of higher level food pyramid species. In July survey, fish and shrimp larvae were dominantly found in the samples..
- Fishery is important livelihood of natives around the survey area of Yangon River. Therefore, most of the species recorded were economically important species such as Nga tha lauk, Nga poke thin, Nga bat and Nga kun shat which are important export species for Myanmar. All other species are also important for local consumption. If water quality of survey area is not affected by pollution, fishery will be stable in the survey area and livelihood of natives will not be affected significantly.

4.8 Eco systems and habitats in that area

The proposed project area lies in the deltaic coast of the Ayeyarwaddy River with no significant character. It is not included in any of endemic bird area and key biodiversity area. In the whole area, there are expanses of open paddy land and small scattered wetland combined with tall, rough elephant grass. Small scattered wetlands combined with shrub and tall elephant grass intersected by paddy fields dominates the whole area. The vegetation along the coast and water edges is composed of mangroves with stunted growth.

(a) **Global Climate Regulating Services:** a few big trees growing in the area can sequestrate minimal amount of carbon and hence it would be negligible to provide ecosystem service in this area.

(b) **Water Services:** Local people in this area do not use water from wetland because they existing fresh water ponds and groundwater sources for domestic purpose. However, there are 4 or 5 fishermen relying on fishery and sometimes they can afford USD 7 per day from fishing.

(c) **Harvested Wild Goods:** No significant wild goods are harvested from the ecosystem because of less development of wetland and mangroves in the area.

(d) **Nature-based Tourism and Recreation:** Ecotourism is to enjoy the nature; this area does not belong to biodiversity and scenic beauty to attract tourists and visitors. Also there are no tourism services in this area according to biodiversity and social impact assessments. Impact on service provided in this respect is very minimal or none.

(e) **Cultivated Good:** as mentioned in the previous section of this report, it is still producing rice in this area. Local farmers have received a certain amount in a compensation of paddy fields and changed their livelihoods to other suitable alternatives. Therefore a service for ecosystem will be only a minimal amount.

5 POTENTIAL SOCIO-ECONOMIC AND ENVIRONMENTAL IMPACTS AND PROPOSED MITIGATION MEASURES

The purpose of this section is to identified and considered the most pertinent socio-economic and environmental impacts and to provide possible mitigation measures that are expected from the feasibility study, planning and design phase, the construction phase and the operation phase including cumulated effects by long term operation.

5.1 Significant Socio-economic and Environmental impacts

The contents of the three phases as mentioned above are: (1) Impacts during feasibility studies, planning and design: impacts on agriculture and land use and impacts on employment and economic opportunity; (2) Impacts during construction phase: impacts on employment and economic opportunity, impacts on health and safety, impacts on air quality, impacts on water quality, impacts on noise level and impacts on traffic and transport; and (3) impacts during operation phase: impacts on employment and economic opportunity, impacts on health and safety, impacts on air quality, impacts on traffic and transport, impacts on biodiversity cumulative impacts and potential disaster risks and hazards.

5.2 Impact Evaluation Criteria

To classify the degree and extent of impact, four fundamental criteria are used for determination of overall importance or significance even if a particular evaluation was attributable to a value judgement – qualitative rather than quantitative data that is not available. This methodology is able to establish acceptable levels and recommend necessary mitigation and monitoring measures to minimize or eliminate impacts. The following criteria are used to evaluate the overall importance of impacts:

Nature of impact: As project area is located on the East bank of Yangon River, natural spring tide normally hit over the area especially in the rainy season. This river tidal-water possesses relatively high saline content which is neither good for paddy field nor people living but mangroves could flourish. If we focus or think about this project area alone, this proposed project is said to have no direct impact on agriculture and land use mainly in terms of issues in relation to rice cultivation and land ownership. However some indirect impact can be expected based on the past actions of the Thilawa Zone land development plan. In other words, the farmers who have to give up their opportunity to use land temporarily will not be happy and that climate would possibly lead towards social tension between developers and native residents.

Duration of impact: The nature of land and its green effect will be changed permanently.

Extent of impact: It is isolated by the project area regardless of the whole Thilawa Industrial Zone.

Intensity of impact: It has very low intensity regarding impact of agriculture and land use.

To have an easy impression, the impact evaluation is summarised and tabulated below:

Sr.	Classified Impacts	(a) Nature, (b) Duration, (c) Extent and (d) Intensity of Impact & (e) Mitigation		
		Planning & Design Phase	Construction Phase	Operation Phase
6	Impacts on Noise Level	-	a) Negative, direct, but no effect on resident area b) Intermittence c) Isolated d) Low e) Comply noise standard, avoiding noising work at night time	a) Negative, direct, but negligible b) All time at plant operation c) Isolated d) Negligible e) Comply noise standard
7	Impacts on Traffic and Transport	-	a) Negative, direct b) Intermittence c) Isolated d) Low e) Proper arrangement on movements of vehicles and transporters	a) Negative, direct b) Intermittence c) Isolated d) Low e) Oil-distribution-trucks should avoid peak-hour movement
8	Impacts on Biodiversity	-	-	a) Almost none b) Permanent nature but not relevant c) Isolated d) Almost none e) NA
9	Cumulative Impacts	-	-	Potential impact on the costal ecosystem by the overall development of Thilawa Industrial Zone e) Setting up an Integrated Coastal/terrestrial Management System (ICM)
10	Potential Disaster Risks and Hazards	-	-	Fire hazard is the most potential one. e) Proper design selection of fire fighting system and lightning protection system

5.3 Proposed Mitigation Measures

As mentioned above, this EIA recommends mitigation measures associated with potential impacts identified that seems an unbinding resolution to create outer-bound for who have committed to comply international and/or local environmental standards. It may mainly concern contractors under the project design and construction phase, and managers and executive branch of the investment company during the operation phase. Mitigation and supporting measures are therefore best achieved through the incorporation of suitable clauses in the construction documents. It would then be the responsibility of the supervising engineer to ensure that the contractor abides by the requirements of these clauses.

- **Mitigation measure:** NA

5.5 Impacts During Construction Phase

5.5.1 Impact on Employment and Economic Opportunity

Hundreds of employment opportunity will open up for local people to be employed as local unskilled and semi-skilled labours more than one year during the construction phase. The project will provide tens of local service providers and suppliers with new sub-contract works. The incoming new technologies will be replicated through skill workforce and supporting services will be internationally more competitive than what it is at the moment. The project will surely boost local production of construction materials such as brick, sand and river shingle.

- **Nature of impact:** Positive and direct impact
- **Duration of impact:** The employment will be shot term. The economic opportunity will be medium term.
- **Extent of impact:** The employment will be local and the economic opportunity will be on regional scale.
- **Intensity of impact:** Moderate
- **Mitigation measure:** NA

5.5.2 Impacts on Health and Safety

The construction and installation activities of the proposed project site clearing and earth filling, excavation, construction of road and drainage, civil structural and building construction, mechanical fabrication, foundation and piling, piping and installation of electrical facilities etc are areas of occupational health and safety in association with the direct negative impacts. There are also some negative impacts can be caused by the interaction of outside workers with the local population during the oil tank farm construction that would increase the spread of transmittable disease like STD and HIV/AIDS.

In the environmental health perspective, the management of sewage and solid waste is considered to be a major concern of public health, which, here focuses on two areas: the first one is the daily living sewage produced by more than 100 workers and their solid waste and the second is the various metal and non-metal waste by construction activities. Both sewage and solid waste should be controlled by providing adequate facilities and practicing proper use, care and maintenance.

- **Nature of compact:** Negative impact; both direct and indirect impacts
- **Duration of impact:** Throughout the construction process that will last for 18 months; to be considered medium term
- **Extent of impact:** Isolated
- **Intensity of impact:** Depends on type and scale of the problem arose
- **Mitigation measures (General):** Construction contractor must brief all staff members on potential risks of injuries on site for safety. The contractors will provide not only adequate protection equipment including helmets, safety gloves, safety boots, safety belts, ear plugs, etc but also adequate drinking water, sanitation facilities, washing and change facilities and emergency facilities including first aid

well. Regarding quality of water in Zarmani reservoir which is potential drinking fresh water source, it is located at the about 5 miles away from the project site, by no mean will not have any negative impact on the water body of the dam. The impact of water quality related to soil erosion is insignificant.

- **Name of impact:** Negative and direct impact (no effect on drinking water source)
- **Duration of impact:** Temporary (less than 1.5 years)
- **Extent of impact:** Isolated
- **Intensity of impact:** Low
- **Mitigation measures:** the constructor will have to comply fully with local and international standards of waste disposal. In compliance with Yangon Port Authority directives all potential pollutants, hazardous materials, petroleum products, lubricants, hydraulic oil, paints and coatings shall be stored in an approved container and disposed. The 50 m free space between the structural construction and rive bank has been allowed for sufficient design to protect soil erosion and the revetments will be built along the river bank.

5.5.5 Impact on Noise Level

The noises of construction equipment like pile-drivers, dozers, scrapers, road rollers, concrete mixers, cranes, generators and compressors etc during the operation time will disturb the neighbours. The noise levels depend on the types of activity performed; for example, a front end loader will generate the noise on the level of 100 decibels (dBA), while a truck will make approximately 85 dBA. The noise of a vehicle should not exceed 85 dBA measured at 7.5 metre or not exceeding 100 dBA measured at 0.5 metre according to Thai Environmental Allocation. It is commonly mentioned that the night time sound level should be around 40 dBA. There is now very less possibility of noise effects to the residential area located at the distance of 2.7 km.

- **Nature of impact:** Negative and direct impact
- **Duration of impact:** Temporary (but also intermittence)
- **Extent of impact:** Isolated
- **Intensity of impact:** Low
- **Mitigation measures:** The main contractor and sub-contractors will take their responsibility for a desirable noise level being maintained on the course of national norms, regional standards and WHO guidelines. Despite local residential area being in a far distance, the contractors should try to avoid noisy construction works in the night time to prevent sleep disturbance to the workers sleeping in the construction site.

5.5.6 Impacts on Traffic and Transport

The main access road from MITT to Thanlyin-Kyauktan road and the ring road of Special Economic Zone were under construction at the time of the environmental assessment survey conducted. Currently, the project site is in an undeveloped area. Only a few companies are being started yet. There is now no traffic problem inside the industrial zone. However, it can be expected that the area will be congested with traffic especially on the way via Thanlyin to Yangon during the construction period. It will create inconvenience to the local population, alter traffic problems, and increase the risks of accidents. In order to avoid the issues most of the construction materials, heavy duty